

Serial No.: 09/900,068
Amendment dated: 2/3/04
Reply to Office Action of: 9/5/03
Attr. Docket No.: GJH-0102

LISTING OF CLAIMS

1. (currently amended) A multi-stage process for removing sulfur and nitrogen components from distillate boiling range petroleum feedstreams containing at least one of said components, in the presence of a hydrogen-containing treat gas, the process which comprises:

reacting said feedstream in a first reaction stage with said hydrogen-containing treat gas in the presence of a bed of catalyst comprised of Co and Mo on a refractory support until the reacted feedstream contains less than about 3,000 wppm sulfur and less than about 1,000 wppm nitrogen; and

reacting said reacted feedstream from said first reaction stage in a second stage with counterflowing hydrogen-containing treat gas in the presence of a bed of catalyst comprised of Ni and one or both of a metal selected from Mo and W, on a refractory support thereby producing at least a final liquid product, wherein said second stage removes sulfur and nitrogen compounds from said reacted feedstream; and:

reacting said final liquid product from said second reaction stage in at least one additional reaction stage wherein said at least one additional reaction stage is selected from the group consisting of an aromatics hydrogenation stage and a hydrocracking reaction stage.

2. (original) The process of claim 1 wherein the process conditions for the first reaction stage include temperatures ranging from about 100°C to about 400°C and pressures from about 50 psig to about 2,000 psig.

3. (original) The process of claim 1 wherein the process conditions for the second reaction stage include temperatures ranging from about 100°C to about 400°C and pressures from about 50 psig to about 2,000 psig.

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4. (original) The process of claim 2 wherein the process conditions for the second reaction stage include temperatures ranging from about 100°C to about 400°C and pressures from about 50 psig to about 2,000 psig.
5. (original) The process of claim 1 wherein the first reaction stage is also operated in countercurrent mode wherein the feedstream and treat gas flow countercurrent to each other.
6. (original) The process of claim 1 wherein the amount of Co in the first reaction stage catalyst is from about 2 wt.% to 20 wt.%, based on the total weight of the catalyst.
7. (original) The process of claim 1 wherein the amount of Mo in the first stage catalyst is from about 5 to about 50 wt.%, based on the total weight of the catalyst.
8. (original) The process of claim 6 wherein the amount of Mo in the first stage catalyst is from about 5 to about 50 wt.%, based on the total weight of the catalyst.
9. (original) The process of claim 1 wherein the catalyst of the second reaction stage is comprised of Ni, Mo, and W.
10. (currently cancelled) The process of claim 1 wherein there is provided at least one additional reaction stage following said second reaction stage, which at least one additional reaction stage is selected from the group consisting of an aromatics hydrogenation stage and a hydrocracking stage.
11. (original) The process of claim 1 wherein one or more of said reaction stages contains at least one vapor passageway extending through or around at least a portion of the catalyst bed of the stage containing said passageway so that a

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portion of upflowing hydrogen-containing treat gas bypasses a vertical portion of said catalyst bed.

12. (currently amended) A multi-stage process for removing sulfur and nitrogen components from distillate boiling range petroleum feedstreams containing at least one of said components, in the presence of a hydrogen-containing treat gas flowing countercurrent to the flow of said feedstream in at least one of the reaction stages, the process which comprises:

reacting said feedstream in a first reaction stage with said hydrogen-containing treat gas in the presence of a catalyst comprised of Co and Mo on a refractory support until the reacted feedstream contains less than about 1,500 wppm sulfur and less than about 750 wppm nitrogen; and

reacting said reacted feedstream from said first reaction stage in a second stage with counterflowing hydrogen-containing treat gas in the presence of a catalyst comprised of Ni, Mo and W, on a refractory support thereby producing at least a final liquid product, wherein said second stage removes sulfur and nitrogen compounds from said reacted feedstream; and

reacting said final liquid product from said second reaction stage in at least one additional reaction stage wherein said at least one additional reaction stage is selected from the group consisting of an aromatics hydrogenation stage and a hydrocracking reaction stage.

13. (original) The process of claim 12 wherein the process conditions for the first reaction stage include temperatures ranging from about 100°C to about 400°C and pressures from about 50 psig to about 2,000 psig.

14. (original) The process of claim 12 wherein the process conditions for the second reaction stage include temperatures ranging from about 100°C to about 400°C and pressures from about 50 psig to about 2,000 psig.

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15. (original) The process of claim 13 wherein the process conditions for the second reaction stage include temperatures ranging from about 100°C to about 400 °C and pressures from about 50 psig to about 2,000 psig.
16. (original) The process of claim 12 wherein the first reaction stage is also operated in countercurrent mode wherein the feedstream and treat gas flow countercurrent to each other.
17. (original) The process of claim 12 wherein the amount of Co in the first reaction stage catalyst is from about 2 wt.% to 20 wt.%, based on the total weight of the catalyst.
18. (original) The process of claim 12 wherein the amount of Mo in the first stage catalyst is from about 5 to about 50 wt.%, based on the total weight of the catalyst.
19. (original) The process of claim 17 wherein the amount of Mo in the first stage catalyst is from about 5 to about 50 wt.%, based on the total weight of the catalyst.
20. (currently cancelled) The process of claim 12 wherein there is provided at least one additional reaction stage following said second reaction stage, which at least one additional reaction stages is selected from the group consisting of an aromatics hydrogenation stage and a hydrocracking stage.
21. (original - was previously misnumbered as 22) The process of claim 12 wherein one or more of said reaction stages contains at least one vapor passageway extending through or around at least a portion of the catalyst bed of the stage containing said passageway so that a portion of upflowing hydrogen-containing treat gas bypasses a vertical portion of said catalyst bed.